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ABSTRACT

Within the framework of a general model of communication, a model of language communication has been developed and applied to the perception of cohesion. To measure students' perception of textual cohesion, a pilot study in the United Kingdom built "noise" into texts by deleting parts of each texts. Subjects, 59 nonremedial students whose first language was either Italian or Punjabi, were given two test booklets in English, one fiction and one nonfiction. Each booklet contained 65 text deletions. Using an accepted guideline of miscue analysis, results did not indicate serious weaknesses in the students' reading at the points measured. Examining the measure of consensus displayed by students' responses leads to the intuitive conclusion that in these cases consensus measure is more important than exact match score. The results confirm that this type of analysis can provide potentially useful insights into readers' text processing strategies. (JL)

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THE MEASUREMENT OF THE PERCEPTION OF COHESION:

A SECOND LANGUAGE EXAMPLE

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The purpose of this article is to describe how students' perception of textual cohesion may be measured. To do this it is necessary first to consider perception of textual cohesion within the general model of communication for this model provides the theoretical underpinning for the technique advocated. Next, a method of quantifying the signals readers receive (that is, readers' perception of signals transmitted by writers) is outlined. The method of measurement is then illustrated using as subjects students for whom English is a second language.

A model of language communication

In any consideration of reading comprehension there is a text (and by implication a writer of the text) and there is a reader. It is for convenience only, as Chapman (1981b) has observed, that text and reader are sometimes considered separately. Any model of reading comprehension or language communication must take into account, at the very least, the interaction of writer, text and reader. The writer, when he encodes meanings in the form of text, selects successively from a set of possible alternatives; similarly, the reader in decoding text selects from the same set of alternatives. If there were perfect communication, the meanings derived by the reader would be identical to those intended by the writer. However, communication is seldom perfect and, as noted by Lyons (1977), any model must allow for this theoretically.

The generalised communication model (see Figure 1) has been widely applied to biological, psychological, social and other systems since it was developed by Shannon and Weaver (1949) to deal with signal transmission. The adaptation of this model to language communication is described by Anderson (1976). Anderson's model (see Figure 2) has four components: the source system (in present discussion, the writer), the message system (the text), the receiver system (the reader), and the noise system (to allow for the possibility of misunderstanding between reader and writer).

Application of the model to perception of cohesion

The previous paper (Chapman 1982) has described Halliday and Hasan's concept of cohesion - the semantic linking mechanisms between sentences that make a text a text (Halliday and Hasan 1976 p.13). In the longitudinal study being conducted from The Open University into post-primary students'

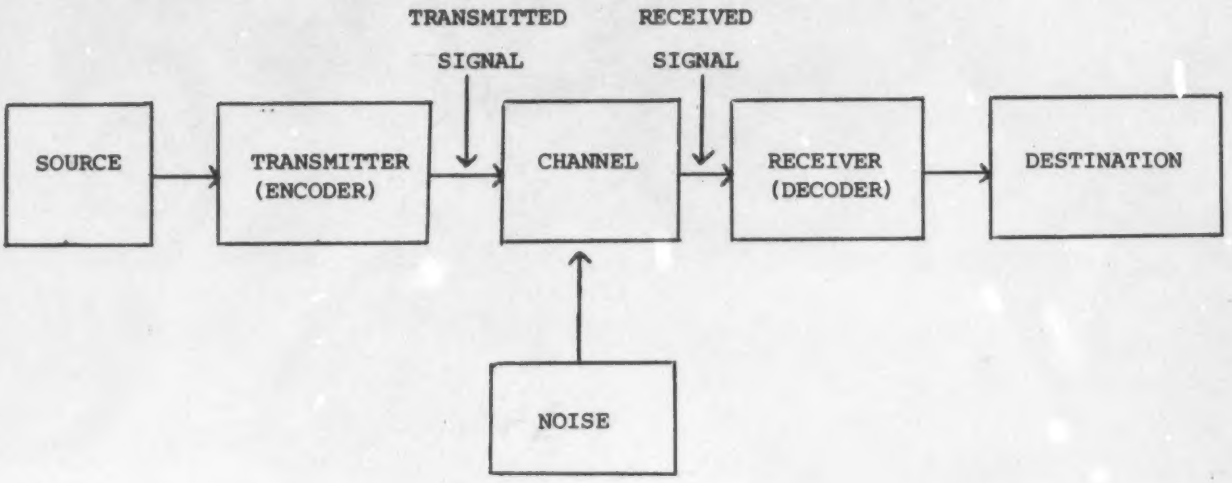

FIGURE 1

A Generalised Communication System

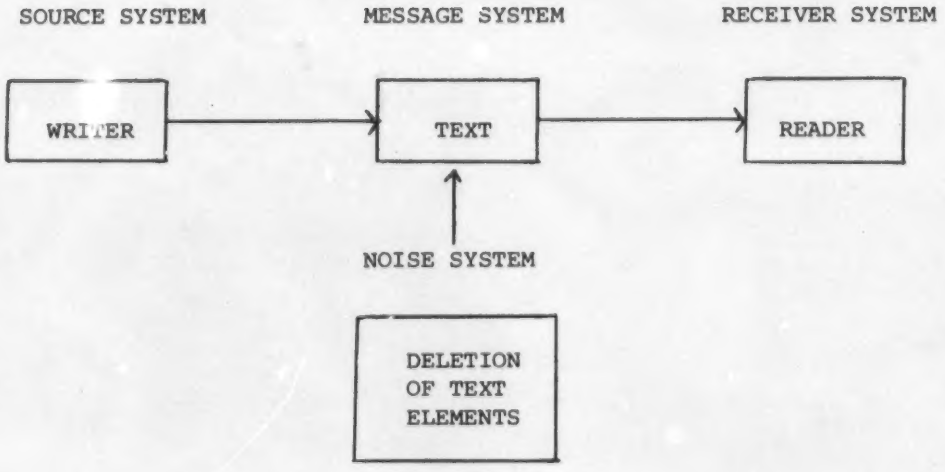

FIGURE 2

A Language Communication Model

perception of textual cohesion (Chapman 1980, 1981a), the between-sentence cohesive ties, in a series of passages representative of reading materials encountered in schools, were identified according to the categories of Halliday and Hasan. The particular use of cohesive ties in texts is part of the choice exercised by writers in their encoding of meaning. To measure students' perception of textual cohesion, one end of each tie identified for inclusion in the study was deleted. In other words, noise was deliberately built into the message system or text by deleting parts of each text and the reader's task was then to restore the deleted text elements and reconstruct the texts.

According to the language communication model depicted in Figure 2, the transmission and receiving of messages are seen as essentially coding operations. The writer in encoding the message is influenced by his encoding habits, his associations, attitudes and values and these habits, associations, attitudes and values are reflected in the coded message or text. Noise in the form of breaks in the pattern of ties between sentences forcibly interrupts the message. In order to decode or recover the message, the reader utilizing all his relevant past experiences (which include his previous learning, his associations, attitudes and values) needs, among other things, to locate the non-deleted end of the tie embedded in the text and make a prediction based upon it and other cues in the text. All this is in accord with the psycholinguistic view of reading which sees the obtaining of meaning from written material as involving strategies of predicting and testing and then confirming or correcting (Goodman 1972; Clay 1976). Now to the extent that readers are successful in restoring the missing ends of each tie and thus completing the semantic links, they are said to have perceived the cohesive ties.

There are several advantages of the model of language communication for measuring perception of textual cohesion. First, students employ, in the task required of them, the same reading strategies as those employed in their other reading. That is, in making predictions, testing these, and then confirming or correcting predictions made, readers make use of the graphophonic, syntactic and semantic cue systems in language (Goodman 1969, 1973; Smith 1973, 1978). Choice points are set up where the deletions occur to provide "a window on the reading process" which otherwise in silent

reading cannot be directly observed. While these choice points may interrupt the reading process, they are not unlike the same choice points faced by the writer in coding the message and, indeed, not unlike the pauses and starts encountered in regular reading. Second, the model permits well established methods of analysis from diverse other fields to be applied, provided due care is taken not to violate basic assumptions. Below, for example, some of the concepts from information theory and some of the theoretical insights from miscue analysis are brought to bear on the quantification of perception of textual cohesion. Third, the model provides a framework for describing what takes place in text comprehension. Fourth, and most importantly, the model is useful to the extent that it provides hypotheses or explains phenomena.

Quantifying perception of textual cohesion

In a slightly different context Osgood (1959) summed up how a model such as that in Figure 2 may be used to measure readers' perception of signals transmitted by a writer:

> The human source that produces the message has a very complex and hierarchical system of language-encoding habits...Similarly, the receivers of his message have equally complex and hierarchical systems of language habits. To the degree that these complex habit systems of source and receiver correspond, one should be able to substitute for the other, that is, should be able to complete his messages (p.79).

The correspondence of the language-encoding habits of writer and the language-decoding habits of reader provides an operational definition of perception of textual cohesion in the special case where one end of a cohesive tie selected by a writer is omitted and the reader's task is to make the most likely replacement. The measurement of this correspondence is also quite straight-forward. One way is to use the writer's chosen word or phrase as the sole criterion and match the reader's replacement against this: an exact match is given credit, a mismatch is not. Alternatively, the procedures of miscue analysis may be adapted and each reader's replacement judged against the writer's original choice in terms of grammatical and semantic acceptability. Replacements are then evaluated in terms of whether both language and meaning (over the span of the tie or over the whole passage) are acceptable, are not acceptable, or are partially acceptable.

The methods of measurement just described above may be used for individual readers or for groups of readers. The essential characteristic of the two measures is that each relies on a criterion (the writer's actual choice of words) against which readers' chosen replacements are judged for correctness. In the one case, exact matches are scored correct; in the other, partial scoring is used depending on the degree of language and meaning retention.

There is a third type of measure which may be computed where there is a group of readers, each of whom attempts to replace the ends of cohesive ties in a given text. This form of measurement, however, differs from those described in that there is no notion of a single correct response; rather all responses elicited by the group of readers are considered and weights applied according to the number of times each response is chosen. The derivation of two such measures - estimated entropy and consensus - are described elsewhere (Anderson 1981) and owe their origins to the mathematical theory of communication. The measure of consensus, as its name implies, is an index of the degree of agreement among respondents. In the two limiting cases, where there is complete agreement among respondents and where there is no agreement at all among respondents, the measure of consensus is unity and zero respectively. Where the responses cluster, the measure takes on an intermediate value; the greater the cluster, the higher the measure of consensus. Entropy is the complementary quantity and may thus be thought of as an index of uncertainty. For instance, where consensus is unity, entropy is zero. The terms estimated entropy and (estimated) consensus are used because the measures are estimates, being based on particular samples of respondents.

Data collection

In parallel to the large-scale longitudinal project noted above into students' perception of textual cohesion (Chapman 1980, 1981a), a small exploratory study was undertaken in a small number of schools with subjects for whom English was a second language. This study was funded by the Research Committee of the Faculty of Educational Studies at The Open University and the assistance afforded in administering the test booklets is duly acknowledged. Below a small part of the data is analysed to

illustrate how students' perception of textual cohesion, as described, is measured.

The five schools participating in the study were all located in Bedfordshire, within easy access of The Open University. The schools were approached because of the known groups of students attending who spoke either Italian or Punjabi as their first language. The purpose of the study was not to make a comparison across language groups (the numbers were in any event too small) but to try out the test booklets with subjects for whom English was not the native language. The only requirement was that the target group should be children who were coping in non-remedial classes. It transpired that some children did not have adequate English even to attempt the test, which was unkind to the children concerned and highlighted the differing interpretations of the term remedial.

It is worth noting the difficulties encountered in selecting the two groups of children with Italian or Punjabi as their first language:

1. No records were kept by the schools of the children's mother tongue, nor were teachers generally aware of what particular Indian or Italian language was spoken at home, nor to what degree it was spoken.

2. Some children were unaware of what the language they spoke at home was called.

3. The only criterion left in many cases was the child's name. This was insufficient evidence upon which to differentiate between Italian and Sicilian and was an area fraught with difficulty in the case of Indian names where many names cross language boundaries and where, in any case, children are often quite unfamiliar with and unable either to write or pronounce the names considered to be their family names.

4. In order to ascertain whether Punjabi/Italian was the children's first or second language, it was necessary to question them individually about what language they spoke at home, thought in and used among friends of the same nationality. This was complicated by the feeling that there was a certain amount of snobbery attached to speaking more English. In some cases it became apparent that the child spoke the mother tongue to one or both parents while using the English among peers both at home and at school.

Two test booklets, one with fiction and the other with non-fiction texts, were administered, each booklet containing 65 text deletions. Of these, 60 items were classified as reference, substitution, conjunction or lexical cohesion (ellipsis was not included) and there were 5 non-cohesive items. Two other test instruments were administered, a standardised reading test and a measure of non-verbal ability, though analysis involving these tests is not discussed here. The testing was carried out over two separate days. Of the 69 subjects tested, full test results were available for 59 (24 Italian and 35 Punjabi) subjects and it is the analysis of these that is reported below.

Evaluating reading responses

The purpose of this section is to illustrate the method of measurement by considering a small selection of the 130 items in the fiction and non-fiction test booklets. The initial examples below are from Halliday and Hasan's (1976) reference category of cohesion (sub-category: personal reference) in which the identity of relation is signalled by the use of personal pronouns, possessive adjectives or possessive pronouns.

Tables 1 and 2 show two segments, one from a fiction and the other a non-fiction text, in which the respective writers use the personal reference [it] anaphorically, to refer back in the fiction text to house and in the non-fiction text to spider. For each segment the responses given by the 59 readers are tabulated in terms of grammatical and semantic acceptability. The judgment of grammatical acceptability can only be made over the sentence in which the deletion occurs; the judment of semantic acceptability, on the other hand, covers not only the span of the cohesive tie but surrounding sentences as well. The 'partially acceptable' category is used where a response is neither clearly acceptable nor clearly unacceptable.

Tables 3 and 4 show two further segments in which the writers' use of the presupposing item [they] refers back in the fiction text to the various children mentioned and in the non-fiction text to labradors (the children and labradors being the presupposed items respectively).

TABLE 1

Responses of 59 Readers to Personal Reference Item [it] in fiction text

The Lion, the Witch and the Wardrobe

..."It is a lovely place, my house," said the Queen. "I am sure you would like_____. There are whole rooms full of Turkish Delight, and what's more, I have no children of my own...

Response	No.	Grammatically Acceptable			Semantically Acceptable		
		Yes	Partially	No	Yes	Partially	No
it	35	✓			✓		
to	6	✓			✓		
this	2	✓			✓		
them	2	✓				✓	
Turkish	2		✓			✓	
Delight	1	✓				✓	
some	1	✓				✓	
stay	1			✓			✓
pig	1			✓			✓
all	1			✓			✓
and	1			✓			✓
-	6			✓			✓
Percentage	100	80	3	17	73	10	17

Exact match = 59%

Consensus = 58%

TABLE 2

Responses of 59 Readers to Personal Reference Item [it] in non-fiction text

The Spider

...Then an insect flies into the web. The insect struggles and the web shakes. The spider's 'telephone' shakes too. The spider comes running down. _____ binds the insect with silk...

Response	No	Grammatically Acceptable			Semantically Acceptable		
		Yes	Partially	No	Yes	Partially	No
it	6	✓			✓		
he	6	✓			✓		
and	15		✓		✓		
then	5		✓		✓		
they	1			✓		✓	
the	13			✓			✓
to	4			✓			✓
but	2			✓			✓
down	1			✓			✓
like	1			✓			✓
telephone	1			✓			✓
-	4			✓			✓
Percentage	100	20	34	46	54	2	44

Exact match = 10%

Consensus = 46%

TABLE 3

Responses of 59 Readers to Personal Reference Item [they] in fiction text

The Children Wait for Magic Man

..."Let's all meet at twelve o'clock on Rosie's cellar door", said Pudgy.
"Twelve o'clock sharp!" said Sal.
"Sharp!" they all agreed.
And then _____ went home.

Response	No	Grammatically Acceptable			Semantically Acceptable		
		Yes	Partially	No	Yes	Partially	No
they	49	✓			✓		
all	2	✓			✓		
we	3	✓				✓	
he	1	✓				✓	
she	1	✓				✓	
went	1			✓			✓
-	2			✓			✓
Percentage	100	95		5	86	8	5

Exact match = 83%

Consensus = 81%

TABLE 4

Responses of 59 Readers to Personal Reference Item [they] in non-fiction text

Labrador Retrievers

Labradors are famous for their obedience, and they are one of the best breeds for training as Guide Dogs for the Blind. Not all kinds learn as well as _____ do, of course, but every dog should be taught to obey...

Response	No	Grammatically Acceptable			Semantically Acceptable		
		Yes	Partially	No	Yes	Partially	No
they	17	✓			✓		
others	3	✓			✓		
labradors	1	✓			✓		
labrador	1		✓		✓		
some	2	✓			✓		
dogs	2	✓					✓
you	6	✓					✓
your	1			✓			✓
well	1			✓			✓
to	1			✓			✓
tan	1			✓			✓
it	1			✓		✓	
we	1	✓				✓	
put	1			✓			✓
blind	1			✓			✓
if	1			✓			✓
-	15			✓			✓
the	3			✓			✓
Percentage	100	52	2	46	41	3	56

The analysis of readers' responses in Tables 1 - 4 is illustrative. Four items only are analysed but certain aspects of the texts, for these subjects, is highlighted. The nature of the task required readers to focus on the underlying threads of continuity within texts, Halliday and Hasan's (1976) text-forming relations. Although the between-sentence ties in the analyses presented here may all be completed with the personal pronoun, examination of the responses shows, as expected, that some factors influencing readers are text dependent (hence responses like Turkish and Delight), while other factors result from interaction of text and reader (and hence seemingly idiosyncratic responses like pig). If the author's choice of a word or phrase to form each tie is taken as criterion of success, the exact match score (per cent correct) gives a general indicator of performance on the test item. However, the listing of all readers' responses may be more revealing for it shows for the group as a whole how much language has been retained (and also how much has been lost), and perhaps more importantly the amount of meaning retained (as well as the amount lost).

In their analysis of miscues Yetta Goodman and Burke (1972) offer as guidelines that losses of 60 per cent or more in language and 70 per cent of more in meaning indicate serious weaknesses in students' reading. Although these suggestions are for individual students with at least 25 miscues, it may not be unreasonable, at least until there is sufficient evidence to show otherwise, to consider similar guidelines for groups of students (say, 25 or more) to individual items as in the present study. Assuming such guidelines for a moment, it is noted that language loss (ie. grammatically non-acceptable responses) for the 4 passages (Tables 1 - 4) ranges from 5 to 46 per cent, and meaning loss (ie. semantically non-acceptable responses) for the same passages ranges from 5 to 56 per cent. These losses are within the 60 and 70 per cent cut-off points respectively and therefore, if these cut-off points are accepted, do not indicate serious weaknesses in students' reading at the points measured. Certainly, examination of the actual responses shows that a majority of students (except for the text on Labrador Retrievers, the most difficult of the four texts) retain meaning and a clear majority (over all passages) retain language.

Thus far little has been said about the measure of consensus displayed in Tables 1 - 4. For three of the texts the measure of consensus is virtually identical to the exact match score based on the author's original word(s). For The Spider text, however, there is a wide divergence between these two measures (46 and 12 per cent respectively). It is not difficult to see why. Only 6 of the 59 subjects made the same choice as the writer [it]; but 6 subjects responded he which is judged semantically and grammatically acceptable; a further 15 responded with and, quite acceptable semantically and partially acceptable grammatically; a further 5 made the response then which again is acceptable semantically and partially acceptable grammatically. In other words, 32 subjects made responses that were judged semantically and grammatically (fully or partially) acceptable though of these only 6 agreed with the writer's actual choice - and it is this difference which is largely reflected in the much higher consensus score compared with the exact match score. Intuitively, the consensus measure seems the more appropriate in this instance.

As a further illustration of the measures described in this article, Tables 5 and 6 display two more text segments, each with three deletions - one an instance of lexical reiteration, another of conjunction (adversative in one text and temporal in the other), and the third of comparative reference. For each deletion there is tabulated the number of different responses elicited by the group of 59 subjects, also the most popular response, the measure of consensus, and the measure of exact matches. The average measure of consensus and of exact matches is also computed over the three deletions in each text. As in a previous example, the measure of consensus is the higher and examination of the most popular response suggests that again it is the more appropriate of the two measures reflecting as it does the several ways of completing cohesive ties and of maintaining the semantic continuity within texts. Indeed, on occasions, the students' most preferred choice, even though these are non-native speakers, seems preferable to that of the writer (presumeably an adult, fluent native speaker). Perhaps this ought not to surprise because children, second language speakers included, often have more feel for language and write more natural texts at their level than those contrived by adults to meet constraints thought to be important.

TABLE 5

Measures of Consensus and Exact Match, together with Number of Different Responses and Most Popular Response, for Fiction Text containing Reference, Conjunction and Lexical Cohesion Items (N = 59)

Mother Duck and the Baby Ducks

...Down the street trotted Mother Duck, with the five baby ducks close behind her... At first they met only a cat... Then they met a dog... Then they met a milkman taking round milk and a paper boy... The cat stared. The _____ stared. The milkman stared. The boy stared. _____ Mother Duck trotted on, and the five baby ducks trotted on behind her. The morning was not _____ early now...

Item deleted	Cohesion type	No. diff. responses	Most pop. response	Consensus	Exact Match
dog	Lexical (reiteration)	21	dog (23)	41%	39%
but	Conjunction (adversative)	9	the (10)	52%	17%
so	Reference (comparative)	16	very (31)	49%	10%
			Average	47%	22%

TABLE 6

Measures of Consensus and Exact Match, together with Number of Different Responses and Most Popular Response, for Non-fiction Text containing Reference, Conjunction and Lexical Cohesion Items (N = 59)

Rocks and Mining

...Sand can be quickly scooped up by a machine called a dredger _____ is used in making glass and concrete. _____ rocks and minerals are mined underground. The miners tunnel under the earth. They blow up the rock in the tunnel. _____ they bring out the loose rock.

Item deleted	Cohesion type	No. diff responses	Most pop. response	Consensus	Exact Match
Sand	Lexical (reiteration)	19	it (20)	42%	17%
Other	Reference (comparative)	10	the (32)	62%	0%
Then	Conjunction (temporal)	14	and (25)	59%	34%
			Average	54%	17%

Summary

Within the framework of a general model of communication a model of language communication has been developed and applied to the perception of cohesion. This model allows an operational definition of the perception of textual cohesion and as well brings together established procedures from other fields, notably concepts from information theory and theoretical insights from miscue analysis. A testing procedure is described which requires subjects, if Halliday and Hasan's (1976) text-forming relations are to be perceived, to trace the connection between presupposing and presupposed links in text. Some data collected in the U.K. with students speaking either Italian or Punjabi as their first language allow the methods of measurement to be demonstrated. Although computerised analytical methods, termed GAP analysis have been developed (Anderson 1981), the methods of analysis are quite easily performed manually. Further, the type of analysis exemplified provides potentially useful insights into readers' text processing strategies.

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